Abstract

THE TRANSFER OF MISSION OPERATIONS FOR THE SPACE TECHNOLOGY RESEARCH VEHICLES

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During the summer of 1996, the day-to-day routine orbital operations of two active research satellites -- the Space Technology Research Vehicles 1A and 1 B -- were transferred from the Defence Evaluation and Research Agency in Great Britain to the University of Colorado in the United States. STRV-1A and STRV-1B were built by the DERA and launched on Ariane flight V64 in June 1994. The satellites were placed into a permanent geosynchronous transfer orbit which exposes them to a variety of dangers: first, they slam into the upper atmosphere at high speed, subjecting their shells to erosion from atomic oxygen; second, they transit through the Van Allen belts, picking up heavy doses of radiation; third, they are exposed to the solar wind where they are subject to electrostatic charging and discharging. The spacecraft were equipped with scientific instruments to study these regimes and they carry a number of technology experiments to test new ways of dealing with these perils. During the nominal one-year life of the satellites and an extended mission of six months, almost all of the scientific and technical objectives of the project were achieved.

In 1996, the STRV-1B spacecraft took on a new task -- one not envisioned when the spacecraft was built -- as a test vehicle for a new set of space-to-ground communications protocols that may ultimately allow spacecraft to be part of the world-wide Internet. The first tests of this Spacecraft Communications Protocol Standard (SCPS) were conducted as a joint activity between DERA, the US Department of Defense, and NASA. After SCPS testing was concluded in May, DERA planned to turn off the STRV-1A and STRV-1B spacecraft, thus freeing resources within the organization to create the next two satellites in the STRV series. However, the Jet Propulsion Laboratory and NASA, impressed by the utility of these spacecraft as orbiting testbeds for new communications technology, asked the University of Colorado's Laboratory for Atmospheric and Space Physics (CU/LASP) to look into the possibility of keeping the STRV spacecraft alive and taking over their day-to-day routine orbital maintenance. CU/LASP personnel visited the DERA's centers at Farnborough and Lasham during May for intensive briefings on the STRV spacecraft and their operations. Between May and August, a new control center was created in Boulder and the transfer of day-to-day operational control of the spacecraft was effected over a three-week period. Since September, the spacecraft have been operated solely from the CU/LASP control center in Boulder. The entire transfer was accomplished in less than four months and for less than $200,000.

This paper describes how this unique transfer of control of two operational spacecraft was carried out and presents lessons learned in accomplishing the transfer quickly while keeping the cost low. The paper describes how the spacecraft's design aided the transfer. It also discusses two key elements that greatly eased the transfer: first, the standards for telemetry and command developed by the Consultative Committee for Space Data Systems; and second, the availability of robust off-the-shelf software that made it possible to quickly assemble a low-cost mission operations center. The paper also presents the status of the communications technology experiments that are now being performed using the satellites.

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